CLEAN DEVELOPMENT MECHANISM
FORM FOR SUBMISSION OF BUNDLED SMALL SCALE PROJECT ACTIVITIES (SSC-CDM-BUNDLE)

SECTION A. General description of the Bundle

A.1. Title of the Bundle:

>>
GHG emission reduction by energy efficiency improvement of clinker cooler in cement manufacturing at Rajashree cement, India

A.2. Version and Date:

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SSC-CDM-Bundle Version: 02
PDD Version: 03, 28th Dec. 2006

A.3. Description of the Bundle and the subbundles :

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Rajashree Cement (RC) is the progressive Cement Manufacturing Company of India, operating since 1984. Rajashree cement belongs to well known Grasim Industries Ltd of Aditya Birla group of companies. RC is manufacturing cement {ordinary portland cement (OPC), portland pozzolana cement (PPC)} & clinker. The present capacity of plant is 4.2 Million TPA. The project activity is applied to line I and III of RC out of three lines of clinker production.

The project activity is performed in two phases for line I:

1. Up-gradation of pre-heater section from (5^{th} stage to 6^{th} stage) as a part of phase one which was completed in year 2001-02
2. Up-gradation of clinker cooler in phase two completed in year 2002-03

The project activity upgrades clinker cooler for energy efficiency in the cement manufacturing process. Cement process Line-I and III of the plant were commissioned with the best available technology by the KHD, Germany. A reciprocating grate cooler was used for clinker cooling.

The project is the redesigning and retrofitting of the grate system with Omega plate type system, which will increase the cooler recuperation efficiency i.e. utilise more heat in clinker cooler. In this project activity new clinker inlet distribution system is used to distribute the clinker on the reciprocating grate. Due to the benefits of the inlet grate system in clinker cooler, the proper cooling of inlet is taking place with additional benefit of high temperature tertiary air ducts.

Project Activity	Type	Category	Technology/Measure
Preheater and Clinker	Type-II: energy	D: Energy efficiency	Preheater upgradation

cooler upgradation in line 1	efficiency improvement projects	and fuel switching measures for industrial facilities	(5th to 6th stage followed with the cooler upgradation.
Clinker cooler upgradation in line 3	Type-II: energy efficiency improvement projects	D: Energy efficiency and fuel switching measures for industrial facilities	Energy efficiency improvement by upgrading the Clinker cooler

A.4. Project participants:

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Name of the party involved ((Host) indicates a host party)	Private and/or public entity (ies) project participants
India (Host)	**Private Entity:** Rajashree Cement Adityanagar, Malkhed Road, District: Gulbarga Karnataka, PIN 585292 India

SECTION B. Technical description of the Bundle:

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B.1. Location of the Bundle:

>> RC is located at P.O. Adityanagar, district Gulbarga (Karnataka). Adityanagar lies between the parallels of latitude 17^0 5' - 17^0 10', and between the meridians of longitude 77^0 10' - 77^0 15'. The location of proposed project activity is at Rajashree Cement. The plant is well connected by railway and road transport.

B.1.1. Host Party(ies):

>> India

B.1.2. Region/State/Province etc.:

>> Karnataka

B.1.3. City/Town/Community etc:

>> Adityanagar, Gulburga

B.1.4. Details of physical location, including information allowing the unique identification of this Bundle:

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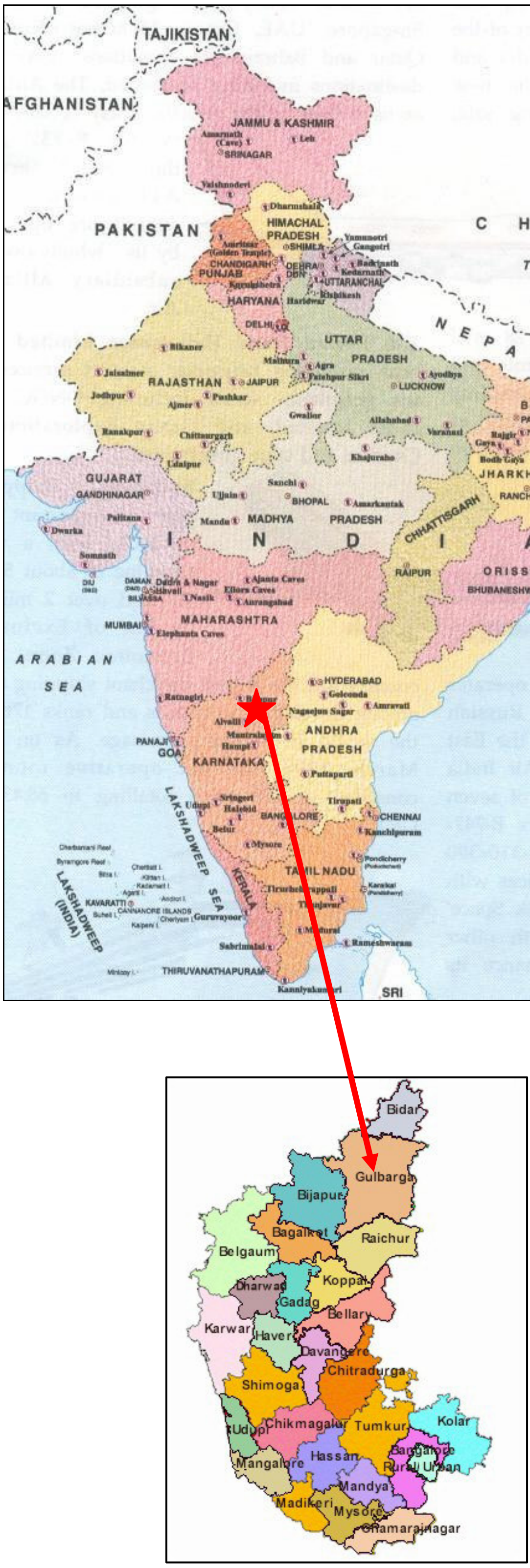
Fig 1 : Location of activity site



B.2. Type(s), category(ies) and technology/(ies)/Measure/(s) of the bundle:

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Type and Category of Project Activity

The project meets the applicability criteria of the small-scale CDM project activity category, Type-II: energy efficiency improvement projects (D: Energy efficiency and fuel switching measures for industrial facilities) of the 'Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories'.

Main Category: Type II – Energy efficiency improvement project

Sub Category: D. Energy efficiency and fuel switching measures for industrial facilities

As per the provisions of appendix B of simplified modalities and procedures for small scale CDM project activities (version 07), Type II D "Comprises any energy efficiency and fuel switching measure implemented at a single industrial facility. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace existing equipment or be installed in a new facility. The aggregate energy savings of a single project may not exceed the equivalent of 15 GWh_e per year. A total saving of 15 GWh_e per year is equivalent to a maximal saving of 45 GWh_{th} per year in fuel input."

As per paragraph 1 of II. D. of appendix B of the UNFCCC defined simplified modalities and procedures for small-scale CDM project activities, 'The aggregate energy savings of a single project may not exceed the equivalent of 15 GWh_e per year. A total saving of 15 GWh_e per year is equivalent to a maximal saving of 45 GWh_{th} per year in fuel input'. The project activity is energy efficiency project and saving depends on the cooler efficiency and clinker production. The efficiency increase will be almost constant and the production may vary within the limit.

The baseline and emission reduction calculations from the project would be based on paragraphs 3 and 4 of appendix B (version 07, dated 28th November 2005) and the monitoring methodology would be based on guidance provided in paragraph 6, 7 and 8 of II D of the same appendix B.

Technology to be applied to the project activity:

Line 1: Preheater up-gradation

Preheater consists of number of cyclones to transfer heat from gases to the material entering at the top stage. It is a counter current flow. Material comes in contact with gas and gets heated up. At the entry point material temperature is approx.70°C, but when it comes to Kiln inlet, its temperature increases upto 1000°C.The gas which flows from kiln is at 1100°C and when it passes out of pre-heater 5th stage, it is approx.300°c and in 6th stage preheater, it is around 260-270°C. A secondary firing is also done in

calciner to increase gas temperature and increase calcination of material and it is around 60% of the total coal required for clinkerisation.

In cyclone of preheater there are two parts. The upper part called riser duct is meant for heat transfer. Where as the cone and cylindrical part acts as a separator. Material falls down and is transferred to another cyclone where as gases are sucked by means of preheater fan.

By this project activity pre heater exist gas temperature reduces to 260°C from 300°C. This 40°C temperature drop gives further reduction in specific fuel consumption. In practice, addition of one stage, raw feed, which enters the pre heater tower, has sufficient time to absorb temperature from gas and cool down pre heater exist gas temperature. By this retrofit measure, it is possible to achieve fossil fuel saving. The project activity reduces specific thermal energy consumption to a great extent and slight increase in specific electrical energy consumption.

Line 1 and 3: Cooler up gradation:
The technology provider was KHD, Germany at inception of the lines. They supplied reciprocating grate cooler for clinker cooling with original plant. The reciprocating grate system comprises rows of alternately fixed and movable grate plates, secured by means of T-bolts to grate support girders. The plates of various grades of steel are used along with the cooler corresponding to the different thermal and mechanical loading conditions. The holes in the rear part of the plate's acts as nozzles, directing the cooling air flow vertically upwards. Air is forced horizontally into the bed of clinker through the gaps between the fixed and the movable plate rows and through the holes in the end faces of the plates. The cooling stream and the continual agitation of the clinker by the grate movements ensure that the clinker particles come into intimate contact with the air.

The project is the redesigning of the grate system with Omega plate type system, which will increase the cooler recuperation efficiency. This Omega type system works due to the design of Omega plates (Row aerated & Chamber aerated). The cooling of clinker takes place faster due to concentrated flow of air to the clinker bed through the row aerated and beam aerated omega plates.

The technology employed is Omega plate type grate cooler system. This technology is the retrofitting of the existing system. It uses the new clinker inlet distribution system to distribute the clinker on the grate. The inlet area consists of 7 fixed rows. The omega grate system consisting of fixed and moving beams. The omega plates are of row aerated and chamber aerated type. Row aerated plates are provided with cooling air for each row of plates through dedicated flexible cooling air lines and chamber aerated rows are provided cooling air through pressurised chamber. The combined effect of row and chamber aerated plates helps in faster cooling of clinker and better heat recuperation through tertiary air duct (TAD) and also reduction clinker temp.

The clinker is transported by inclination of the inlet and by the cooling air.

B.3. Estimated amount of emission reductions over the chosen crediting period:

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Line 1:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	14112
2008	14112
2009	14112
2010	14112
2011	14112
2012	14112
2013	14112
2014	14112
2015	14112
2016	14112
Total estimated reductions	

Year	Annual estimation of emission reductions in tonnes of CO_2 e
(tones of CO_2 e)	**141120**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**14112**

Line 3:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	13281
2008	13281
2009	13281
2010	13281
2011	13281
2012	13281
2013	13281
2014	13281
2015	13281
2016	13281
Total estimated reductions (tones of CO_2 e)	**132810**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**13281**

Consolidated

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	27393
2008	27393
2009	27393
2010	27393
2011	27393
2012	27393
2013	27393

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2014	27393
2015	27393
2016	27393
Total estimated reductions (tones of CO_2 e)	**273930**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**27393**

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the Bundle
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C.1.1. Starting date of the Bundle:
>> 18/01/2001

C.2. Choice of crediting period and related information:
>> Fixed

C.2.1. Renewable crediting period:
>> Not Applicable

C.2.1.1. Starting date of the first crediting period:
>> Not Applicable

C.2.1.2. Length of the first crediting period:
>> Not Applicable

C.2.2. Fixed crediting period:
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C.2.2.1. Starting date:
>> The crediting period will start from the date of registration. For calculation purposes 01/01/2007 is mentioned as crediting period.

C.2.2.2. Length:
>> 10 years 0 months

SECTION D. Application of a monitoring methodology:

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Title: Monitoring Methodology for the category II D – Energy efficiency and fuel switching measures for industrial facilities.

Reference: 'Paragraph 6 to 8' as provided in Type II.D. of Appendix B of the simplified modalities and procedures for small-scale CDM project activities - Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories.

Common Monitoring Plan

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.1	Clinker production (Clk)	Plant	Tons/day	Measured and calculated	Recorded continuously	100%	Electronic	The clinker production will be calculated from the raw meal consumption and the raw meal to clinker conversion factor. Raw meal consumption: Raw meal supplied at Kiln inlet is measured by Solid Flow Meter. Conversion factor: The conversion factor is given by the government agency national council for concrete and building materials.(NCCBM). Calibration: Annual calibration from equipment supplier. Loss in weight of kiln feed system is checked through "intecont plus" controller and the procedure is inbuilt and the programmed in the chip. Frequency : Annual Data retention period: Crediting period + 2 years
P.2	Quantity of	Plant	Tons/month	Measured and	Recorded	100%	Electronic	Instrument used: Transweigh make loss in

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	fuel consumed (Q_{Fuel})			calculated	continuously and reported monthly			weight equipment Calibration: Internal calibration with standard calibrated weights. Frequency: Annual Data retention period: Crediting period + 2 years
P.3	Emission factor of fuel (EF_{Fuel})	IPCC	TCO_2/TJ	Fixed	Fixed	100%	Electronic	IPCC 2006 default values, Fixed
P.4	Calorific value of fuel consumed (CV_{Fuel})	Plant	Kcal/kg	Measured	Recorded continuously and reported monthly	100%	Electronic	By Bomb Calorimeter with standard procedure as given by the OEM is done in the plant lab. Calibration: By Benzoic acid powder/ tablet test for the bomb calorimeter. Data retention period: Crediting period + 2 years
P.5	Average emission factor ($EF_{average}$)	Plant	TCO_2/TJ	Calculated	Monthly	100%	Electronic	Calculated as per the equation 15.
Clinker cooler Efficiency calculations								
P.6	Inlet	Plant	°C	Estimated	Fixed	100%	Electronic	The inlet temperature of clinker in cooler is

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	temperature of clinker in cooler ($T_{Clk\ In}$)							estimated constant in pre and post project scenario, based on the data given by technology supplier. Data retention period: Crediting period + 2 years
P.7	Specific heat of clinker ($S_{Clk\ In}$)	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Weekly	100%	Electronic	Calculated as per eq 2 of calculation. Data retention period: Crediting period + 2 years
P.8	Inlet temperature of cooling air in cooler ($T_{Cooling\ Air}$)	Plant	°C	Measured	Daily	100%	Electronic	Average temperature of minimum and maximum ambient temperature. The mercury thermometer (Dry and wet bulb thermometer) is used for the same. Data retention period: Crediting period + 2 years
P.9	Density of air (D_a)	Data book	Kg/m^3	Calculated	Weekly	100%	Electronic	Calculated as per eq 3 in the project calculation section. Data retention period: Crediting period + 2 years
P.10	Volume	Plant	M^3/hr	Measured &	Weekly	100%	Electronic	Measured as per the piezeometer reading in the

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	flow rate of cooling air in cooler ($M_{Cooling\ Air}$)			Calculated				control room and cross checked with the anemometer readings from individual cooler fans. Data retention period: Crediting period + 2 years
P.11	Specific heat of cooling air ($S_{Cooling\ Air}$)	Formulae provided by technology suppler	Kcal/ kg/°C	Calculated	Fixed	100%	Electronic	Calculated as per eq 2 in the project calculation section. Data retention period: Crediting period + 2 years
P.12	Power consumed by cooler fans (P_{Fan})	Plant	KWh /day	Measured	Monitored continuously and reported weekly	100%	Electronic	Instrument used: Energy meter including auxiliaries Class: 0.5 S Make: Enercon Data retention period: Crediting period + 2 years
P.13	Exhaust air temperature from cooler ($T_{Exhaust\ Air\ Cooler}$)	Plant	°C	Measured	Weekly	100%	Electronic	Instrument used: K type Thermocouple. Calibration: Internal Frequency: Annual Data retention period: Crediting period + 2 years
P.14	Static	Plant	mm water	Measured	Weekly	100%	Electronic	Instrument used: Pitot Tube with digital

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	Pressure from ESP exhaust ($StPr_{ESP\ Exhaust}$)		gauge					/mercury manometer. Calibration: External Frequency: Annual Data retention period: Crediting period + 2 years
P.15	Dynamic Pressure from ESP exhaust ($DyPr_{ESP\ Exhaust}$)	Plant	mm water gauge	Measured	Weekly	100%	Electronic	Instrument used: Pitot Tube with digital /mercury manometer. Calibration: External Frequency: Annual Data retention period: Crediting period + 2 years
P.16	Mass flow rate of cooler exhaust gas ($M_{Exhaust\ gas}$)	Plant	kg/hr	Measured & Calculated	Weekly	100%	Electronic	Calculated as per equation 8 in the calculation.
P.17	Specific heat of cooler Exhaust gas ($S_{Exhaust\ gas}$)	Formulae provided by technology suppler	Kcal/ kg / °C	Calculated	Fixed	100%	Electronic	Calculated as per eq 2 in the project calculation section. Data retention period: Crediting period + 2 years

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.18	Temperature of clinker dust from cooler ($T_{Dust\ cooler}$)	Plant	°C	Estimated	Weekly	100%	Electronic	Temperature of dust will be same as exhaust air temperature from cooler. Data retention period: Crediting period + 2 years
P.19	Clinker dust from cooler ($M_{Dust\ Cooler}$)	Plant	Kg /m^3 of exhaust air	Estimated	Every six month	100%	Electronic	Equipment used is the environmental test equipment. The test is considered monthly. Data retention period: Crediting period + 2 years .
P.20	Specific heat of clinker Dust rom cooler ($S_{Dust\ cooler}$)	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Fixed	100%	Electronic	Calculated based on the equation no 2. in project calculation section. Data retention period: Crediting period + 2 years
P.21	Temperature of clinker from cooler ($T_{Clk\ Out}$)	Plant	°C	Calculated	Weekly	100%	Electronic	The date is online monitored in control room. Instrument used: K type Thermocouple. Calibration: Internal Frequency: 6 months Data retention period: Crediting period + 2 years
P.22	Clinker	Plant	TPD	Measured and	Daily	100%	Electronic	Difference of clinker inlet and clinker dust

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	from cooler ($M_{Clk\ Out}$)			Calculated				
P.23	Specific heat of clinker from cooler ($S_{Clk\ Out}$)	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Fixed	100%	Electronic	Calculated based on the equation no 2. in project calculation section. Data retention period: Crediting period + 2 years
P.24	Radiation losses from cooler (R_{Loss})	Data book	Kcal/hr	Calculated	Weekly	100%	Electronic	6 Kcal/kg of Clinker. Fixed value is used as per the data given by technology supplier.
P.25	Kiln running hours (K hrs)	Plant	Hrs	Monitored	Daily	100%	Electronic	Monitored daily from control room. Data retention period: Crediting period + 2 years
P.26	Cooler Efficiency (Eff_{Cooler})	Plant	%	Calculated	Weekly	100%	Electronic	Calculated as per eq 14 of the calculation. Data retention period: Crediting period + 2 years

Annex 1

CONTACT INFORMATION OF PARTICIPANTS IN THE PROJECT ACTIVITY

Organization	Rajashree cement
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